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## (54) A Refrigeration System for Drink Dispensing Machine

(57) A refrigeration system consists of a compressor which circulates a refrigerant through a closed circuit including an evaporator coil 20 and a heat exchanger. A secondary heat exchanger is mounted within the evaporator coil so as to be cooled thereby and consists of a container (22) through which the liquid, which is to form a drink, is passed. The

container is provided adjacent one end with a liquid inlet (30) and adjacent the opposite end with a liquid outlet (32), and baffles (34) are mounted in the container to inhibit the direct flow of liquid between the inlet and the outlet. When carbonated drinks are to be supplied by the drink dispensing machine, a carbonator unit is mounted in the container and the supply of liquid to the carbonator is drawn from the liquid outlet of the container which forms the secondary heat exchanger.

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

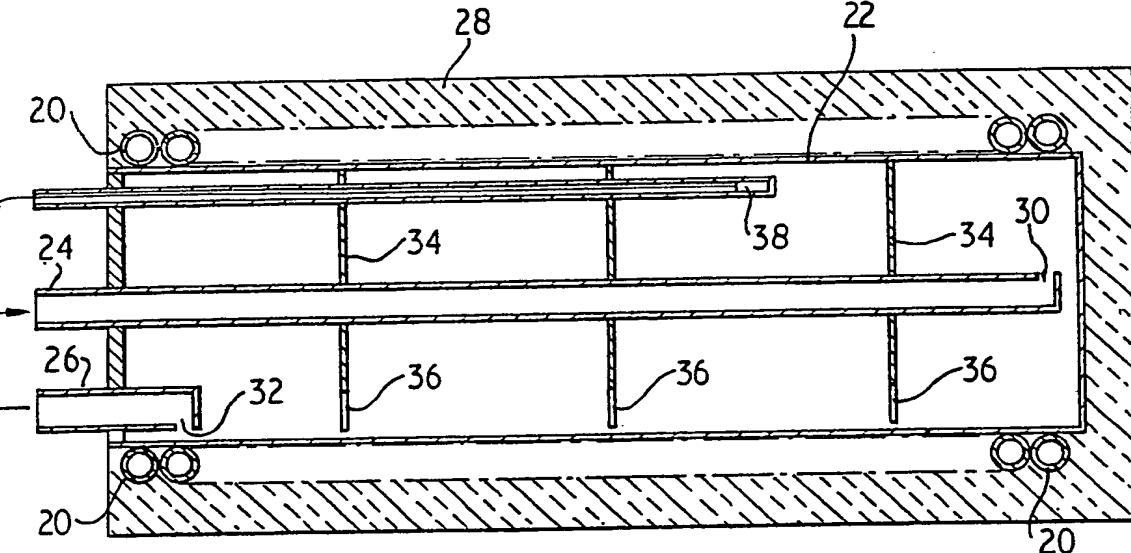


FIG. 2.

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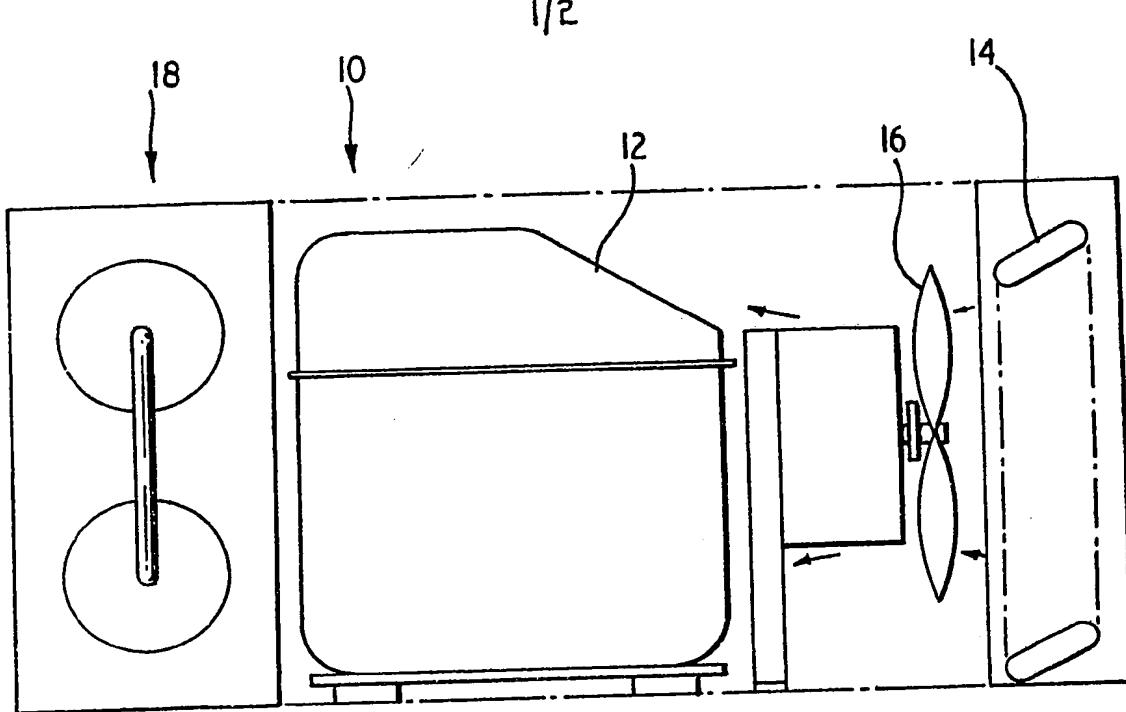


FIG. 1.

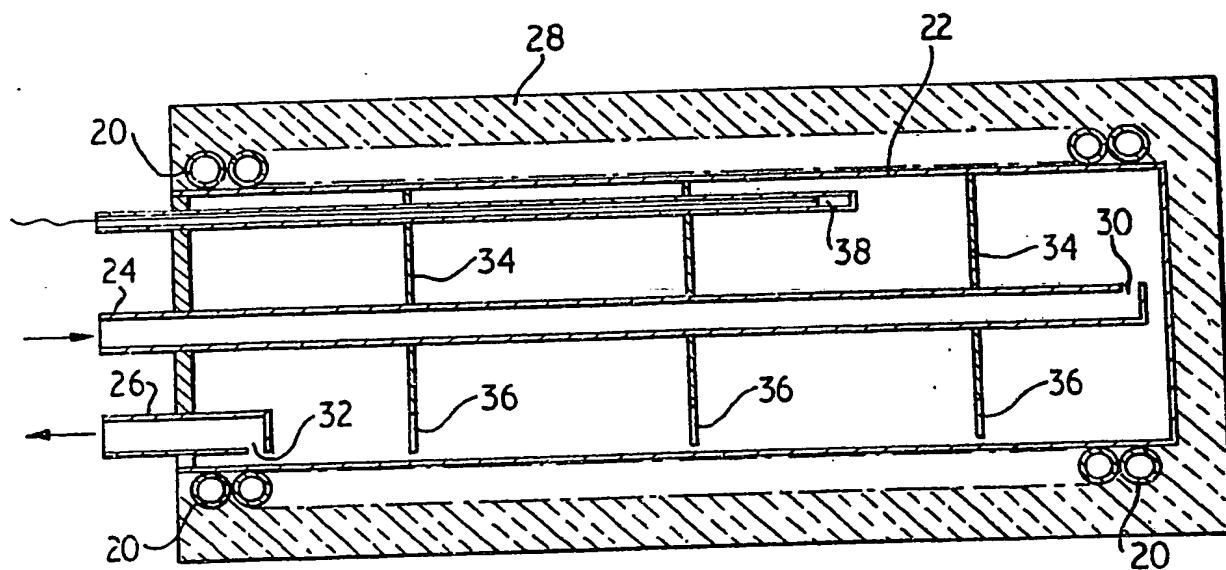
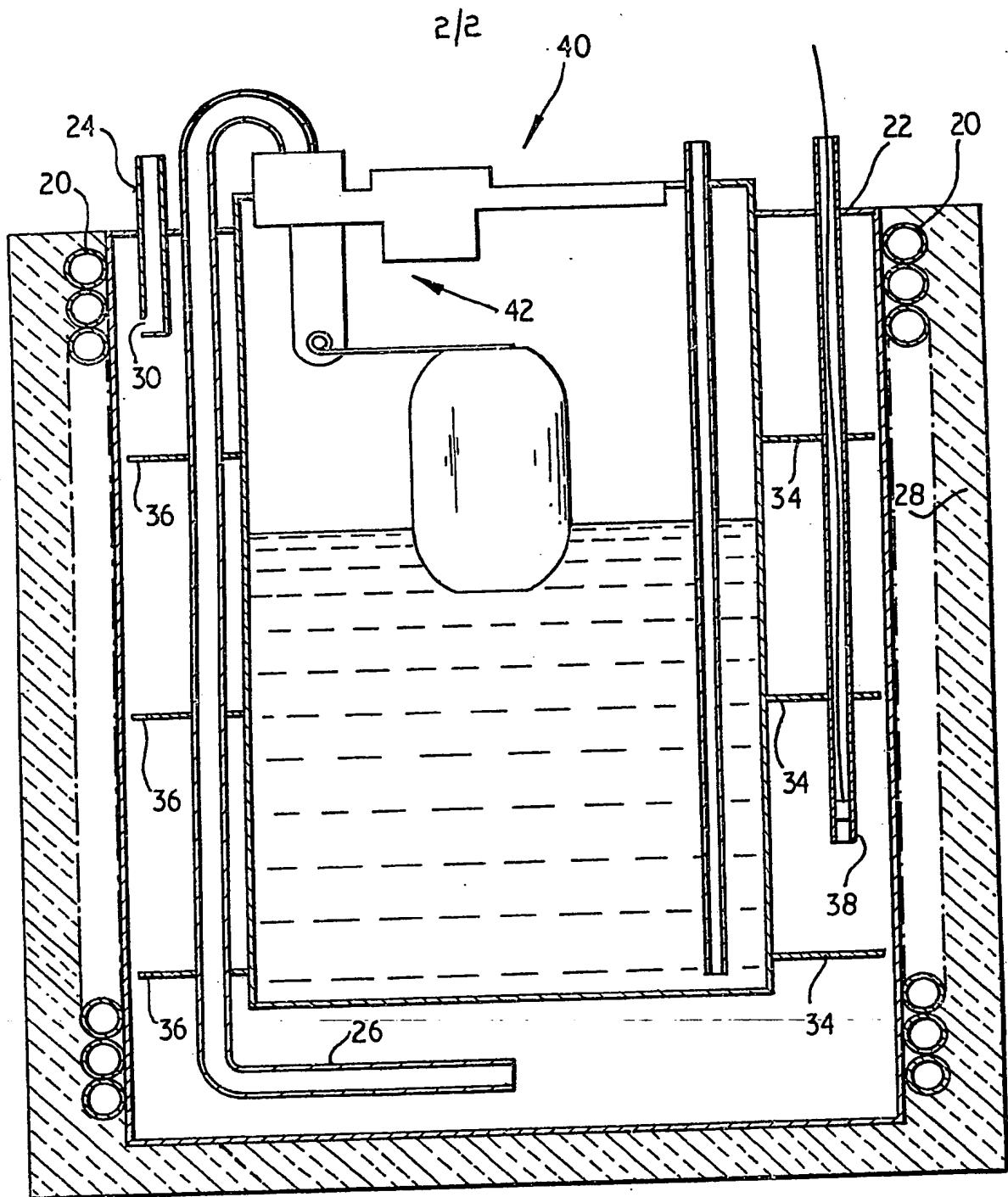


FIG. 2.

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**SPECIFICATION**  
**An Improved Refrigeration System**

This invention relates to a refrigeration system and more particularly, but not exclusively, to a refrigeration system for use in a drink dispensing machine.

A conventional refrigeration system for use in a drink dispensing machine comprises a compressor for circulating a refrigerant such as, for example, freon through a closed circuit including an evaporator coil and a heat exchanger. The evaporator coil containing the refrigerant is used to extract heat either directly or indirectly from the liquid which is to form the drink by either winding a coil carrying said liquid in close touching contact with the evaporator coil or by using the evaporator coil to cool a water bath and form a bank of ice therein which is then utilised to cool the liquid from which the drink is to be formed by passing the liquid through a cooling coil mounted within the water bath.

The first direct type of refrigeration system referred to above has the advantage of being a relatively compact and space-saving assembly, but when a large number of drinks are being served by the drink dispensing machine during a short period of time, there is no facility to provide a reserve of "cold energy" which can be drawn upon. It is therefore necessary to ensure that the entire refrigeration system; including the compressor, the heat exchanger, the evaporator coil and the cooling coil for the liquid which is to form the drink; is of sufficient capacity to meet any maximum demand imposed upon the machine and thus it is usually necessary for such a system to have a larger capacity than the average demand imposed on the drink dispensing machine would normally require.

The second indirect type of refrigeration system utilising a water bath in which a bank of ice is formed as a reserve of "cold energy" does not suffer from the above disadvantage and thus a smaller compressor, evaporator coil and heat exchanger can theoretically be used in this system than in the direct type of refrigeration system to meet the same maximum short term demand. However, it is found that the water bath in which the bank of ice is formed occupies a considerable space and it is also been found to be necessary to provide further ancillary equipment such as, some form of agitation means in the water bath to distribute the cold water therein evenly around the cooling coil for the liquid which is to form the drink.

The object of this invention is to provide a refrigeration system which possesses the advantages of the known system and in which the disadvantages of said systems are alleviated.

According to this invention, a refrigeration system for use in a drink dispensing machine comprises a compressor, which is adapted to circulate a refrigerant through a closed circuit including an evaporator coil and a first heat exchanger; and a second heat exchanger

65 assembly, comprising a container mounted in thermal contact with the evaporator coil, said container having an inlet and an outlet formed therein through which the liquid to be cooled can flow, and baffle means mounted in the container for inhibiting the direct flow of liquid from the inlet to the outlet.

Preferably, the container of the second heat exchanger assembly is mounted within the evaporator coil in thermal contact therewith.

70 Preferably, also, the evaporator coil with the second heat exchanger assembly mounted therein is encapsulated within a layer or block of thermal insulating material. The container of the second heat exchanger assembly is, preferably, a cylindrical container having closed ends.

75 Preferably, the inlet is provided at or adjacent to one end of the container and the outlet is provided at or adjacent to the opposite end thereof so that liquid flowing therebetween flows along the major portion of the length of the container. Preferably, also, the inlet and/or the outlet are arranged so that the liquid flowing into the container is directed towards the periphery of the container and/or is withdrawn from the peripheral portion of the container.

80 The baffle means, preferably, comprises one or more plates extending across substantially the full width of the container and each plate is provided at or adjacent to the periphery thereof with one or 85 more slots through which the liquid can flow. Preferably, each slot is arranged to direct the liquid flowing therethrough radially outwardly and tangentially to the internal peripheral surface of the container.

90 95 100 The second heat exchanger assembly may comprise two containers connected in series, each being in thermal contact with the evaporator coil, the outlet of the first container being connected to the inlet of the second container.

105 In addition, the container of the second heat exchanger may have a carbonator unit mounted centrally therein.

A preferred embodiment of this invention will now be described, by way of example only, with reference to the accompanying drawings of which:

Figure 1 is a diagrammatic side elevation of a refrigeration system;

Figure 2 is a sectional plan view of a heat exchanger assembly forming part of said system; and

Figure 3 is a diagrammatic sectional side elevation of a modified heat exchanger assembly.

In Figures 1 and 2 of the drawings a refrigeration system indicated generally at 10 for a drink dispensing machine (not shown) comprises a compressor 12, a heat exchanger 14 and a cooling fan 16. A secondary heat exchanger assembly indicated generally at 18 is mounted adjacent to the compressor 12 and incorporates evaporator coils 20.

Referring now particularly to Figure 2 of the drawings, the secondary heat exchanger comprises two separate units, each unit

consisting of a cylindrical container 22 having closed ends which is mounted within one of the evaporator coils 20 in thermal contact therewith. The container 22 is formed of a good thermal conducting material, such as stainless steel, and is provided with inlet and outlet tubes 24 and 26 respectively. The two containers 22 forming the secondary heat exchanger 18 are connected in series, that is to say, the outlet tube 26 of the first 5 container 22 is connected to the inlet tube 24 of the second container 22. Each of the containers 22 and the associated evaporator coil 20 are encapsulated within a layer or block of thermal insulating material 28.

10 15 The inlet tube 24 extends along the length of the container 22 and is provided at its end with an outlet aperture 30 which is arranged to direct water flowing therethrough into the container 22 towards the periphery thereof. The outlet tube 26 20 is also provided with an aperture 32 which is arranged so that water withdrawn through the outlet tube 26 is taken from a point adjacent to the periphery of the container 22.

25 Three circular baffle plates 34 are mounted in the container 22 so as to extend across the full width thereof and the three plates 34 are disposed at spaced-apart positions along the length of the container 22 between the aperture 30 of the inlet tube 24 and the aperture 32 of the 30 outlet tube 26. Each baffle plate 34 is provided with one or more slots 36 extending radially inwardly from the periphery thereof and the sides of each slot 36 are angled so as to direct the water flowing therethrough radially outwardly and 35 tangentially to the internal peripheral surface of the container 22. The direction of the water flowing through the slots 36 in each baffle plate 34 is arranged so that the flow of water constitutes a helical or spiral flow along the 40 internal peripheral surface of the container 22.

45 A temperature sensing device 38 is mounted in the container 22 adjacent to the periphery thereof and although any suitable thermal temperature sensing device can be used, it has been found that a thermistor is particularly suitable.

50 In operation, the compressor 12 circulates a refrigerant, such as freon, through a closed circuit including the heat exchanger 14 and the evaporator coils 20 of the secondary heat exchanger assembly 18. The evaporator coils 20 cool the associated containers 22 and the water contained therein until a desired reduction in temperature is achieved, whereupon the 55 temperature sensing device 38 senses that the desired temperature has been achieved, and the compressor 12 is switched off.

60 The compressor 12 can be arranged to remain in operation until the water in the container 22 adjacent to the periphery thereof actually freezes and a build-up of ice occurs on the internal peripheral surface of the container thereby forming a reservoir of "Cold Energy". When the water in the container 22 is drawn off through the outlet tube 26 to form a drink, the water is drawn 65 through the aperture 32 from the coldest portion

of the container 22, that is to say from a point adjacent to the periphery thereof.

As water is drawn from the outlet tube 26, additional water is supplied through the inlet tube

- 70 24. During this operation, water flows from the aperture 30 along the length of the container 22 and the provision of the baffle plates 34 ensures that the water flowing along the length of the container does not pass directly from the aperture 75 30 of the inlet tube to the aperture 32 of the outlet tube. The baffle plates 34 and the slots formed therein ensure that the water flowing through the container traverses as long a path as possible thereby subjecting this water to the 80 maximum cooling effect.

The orientation and angle of the sides of the slots 36 in the baffle plates 34 are such as to cause the water flowing through the container to flow in a helical or spiral path along the periphery 85 of the container 22 in order to subject the water to the maximum cooling effect.

Referring now to Figure 3 of the drawings, in a modification, where the refrigeration system is used in a drink dispensing machine which

- 90 dispenses carbonated drinks, one of the many possible adaptations involves the mounting of a carbonator unit within the secondary heat exchanger assembly to form an integral part thereof, and the various components of this 95 modification which correspond to the refrigeration system described in Figures 1 and 2 of the drawings have been allocated the same reference numerals utilised in said Figures 1 and 2 of the drawings.

- 100 In Figure 3 of the drawings, a single evaporator coil 20 is utilised and this evaporator coil is disposed in a vertical rather than a horizontal plane. The cylindrical container 22 having closed ends is mounted within the evaporator coil 20 105 and the coil 20 and the container 22 are encapsulated within a block of thermal insulating material 28. A carbonator tank indicated generally at 40 is mounted centrally within the container 22 and three annular baffle plates 34 are 110 mounted at spaced-apart positions in the external surface of the carbonator tank 40 and extend horizontally towards the internal surface of the container 22. Each baffle plate 34 is provided with one or more slots 36 adjacent to the 115 periphery thereof and once again, the side surfaces of each slot 36 are angled so as to direct the water flowing therethrough radially outwardly and tangentially to the internal peripheral surface of the container 22 thus producing a spiral flow of 120 the water flowing through the slots along the internal peripheral surface of the container 22.

- The carbonator tank 40 is provided with a float operated inlet valve assembly indicated generally at 42 to enable water to enter the carbonator tank 125 40 and this inlet valve assembly 42 is connected to the outlet tube 26. The outlet tube 26 is disposed in the container 22 so that it draws water from the lower portion of the container and due to the vertical disposition of the container 22

the coldest water therein tends to collect in this lower portion.

The inlet tube 24 through which water is supplied to the container 22 is again provided at its end with an outlet aperture 30 which is arranged to direct water flowing therethrough towards the internal peripheral surface of the container 22. The container 22 is again provided with a temperature sensing device 38 which is utilised for controlling the operation of the compressor of the refrigeration system.

The operation of this modified secondary heat exchanger is substantially the same as the operation of the system described with reference to Figures 1 and 2 of the drawings, the only minor difference being the introduction of the water to the inlet tube 24 at the top of the container 22 and the withdrawal of the cold water from the lower portion of the container 22 through the outlet tube 26.

In a further modification, probe devices are mounted in the container 22 adjacent to the periphery thereof to sense the buildup of ice on the interior thereof and are arranged once the ice has reached a desired thickness to de-activate the compressor 12.

It will be appreciated that in a refrigeration system, the above described secondary heat exchanger assemblies form compact and space-saving units which possess the advantage of providing a reserve of "cold energy" in the form of a layer of ice formed on the internal peripheral surface of the container 22 which can be drawn upon during a period of maximum demand for cold drinks from the drink dispensing machine. This clearly enables a smaller compressor 32 to be utilised in the refrigeration system than would be required if the compressor had to be of sufficient capacity to meet any maximum demand for drinks without the benefit of such a reservoir of "cold energy".

#### Claims

1. A refrigeration system for use in a drink dispensing machine comprising a compressor, which is adapted to circulate a refrigerant through a closed circuit including an evaporator coil and a first heat exchanger; and a second heat exchanger assembly, comprising a container mounted in thermal contact with the evaporator coil, said container having an inlet and an outlet formed therein through which the liquid to be cooled can flow, and baffle means mounted in the container for inhibiting the direct flow of liquid from the inlet to the outlet.
2. A refrigeration system according to Claim 1, wherein the container of the second heat exchanger assembly is mounted within the evaporator coil in thermal contact therewith.
3. A refrigeration system according to Claim 1 or Claim 2, wherein the evaporator coil with the second heat exchanger assembly mounted

therein is encapsulated within a layer or block of thermal insulating material.

4. A refrigeration system according to any one of the preceding claims, wherein the container of the second heat exchanger assembly is a cylindrical container having closed ends.

5. A refrigeration system according to Claim 4, wherein the inlet is provided at or adjacent to one end of the container and the outlet is provided at or adjacent to the opposite end thereof so that liquid flowing therebetween flows along the major portion of the length of the container.

6. A refrigeration system according to any one of the preceding claims, wherein the inlet and/or the outlet are arranged so that the liquid flowing into the container is directed towards the periphery of the container and/or is withdrawn from the peripheral portion of the container.

7. A refrigeration system according to any one of the preceding claims, wherein the baffle means comprises one or more plates extending across substantially the full width of the container and each plate is provided at or adjacent to the periphery thereof with one or more slots through which the liquid can flow.

8. A refrigeration system according to Claim 7, wherein each slot is arranged to direct the liquid flowing therethrough radially outwardly and tangentially to the internal peripheral surface of the container.

9. A refrigeration system according to any one of the preceding claims, wherein the second heat exchanger assembly comprises two containers connected in series, each being in thermal contact with the evaporator coil, the outlet of the first container being connected to the inlet of the second container.

10. A refrigeration system according to any one of Claims 1 to 8, wherein the container of the second heat exchanger has a carbonator unit mounted centrally therein.

11. A refrigeration system constructed, arranged and adapted to operate substantially as herein before described with reference to, and as illustrated by, the accompanying drawings.

New Claims or Amendments to Claims filed on 29th Oct 1980.  
Superseded Claim 1.

#### 110 New or Amended Claims:—

1. A refrigeration system for use in a drink dispensing machine comprising a compressor, which is adapted to circulate a refrigerant through a closed circuit including an evaporator coil and a first heat exchanger; and a second heat exchanger assembly, comprising a container mounted in thermal contact with the evaporator coil, said container having an inlet and an outlet formed therein through which the liquid to be cooled flows; and baffle means mounted in the container which is adapted to permit the flow of liquid

therethrough and to direct said liquid flow towards the internal peripheral surface of the

container whilst inhibiting the direct flow of liquid from the inlet to the outlet.

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